TABLE 3. RELATIVE EFFECT OF A CHANGE IN THE OIL PRICE ON THE PRICES OF GASOLINE IN SELECTED WESTERN COUNTRIES (U.S. cents per gallon)

Country	October 1973 a/			June 1979 b/		
	Price, Including Tax c/	Tax	Percentage Rise in Gasoline Price Relative to Percentage Rise in the U.S. Gasoline Price d/	Price, Including Tax c/	Tax	Predicted Percentage Rise in Gasoline Price Relative to Percentage Rise in the U.S. Gasoline Price d/
United States	40	12	1.00	86	13	1.00
France	100	68	0.40	241	156	0.36
Italy	108	81	0.37	216	156	0.40
United Kingdom	69	43	0.58	184	79	0.47
West Germany	99	71	0.40	198	110	0.43

SOURCE: Prices and taxes for regular gasoline taken from Central Intelligence Agency, National Foreign Assessment Center, International Energy Review (June 24, 1980), p. 20.

a/ Converted to end-of-1973 exchange rates, using IMF, International Financial Statistics (April 1980), p. 10 and (July 1980), passim.

b/ March 1979 exchange rates.

c/ Data shown in Table 4 correct for the changes in home currency gasoline prices that occur because of exchange rate fluctuations. Such fluctuations alter home currency gasoline prices because the OPEC oil price is set in dollars. (See Appendix B for a discussion of how the correction is made.)

d/ Relative price impact is calculated as follows: The gasoline price in any foreign country (P_f) is the sum of the underlying oil price (P) and the tax (T_f), or $P_f = (P + T_f)$; the percentage rise in the price in a foreign country will be $dP_f/P_f = (dP)/(P + T_f)$. The rise in the U.S. gasoline price may be expressed in the same way, substituting U.S. for the "f" subscript. Dividing the foreign percentage price increase by the U.S. percentage price increase, and noting that each country faces the same increase in the OPEC price (dP), produces the percentage increase in the foreign price relative to the percentage increase in the U.S. price, or $(P + T_{US})/(P + T_f)$.

federal tax unchanged. Hence, the expected relative percentage impact of an oil price rise on U.S. gasoline prices in 1979 remained more than twice that for European countries (Table 3). The actual differences during this period were about as expected, except, inexplicably, for the United Kingdom (Table 4). Table 4 shows price data corrected for the changes in home currency gasoline prices that occur because of exchange rate fluctuations. Such fluctuations alter home currency gasoline prices because the OPEC oil price is set in dollars. (Appendix B discusses this correction.)

TABLE 4. HOME CURRENCY PRICE CHANGES OF REGULAR GASOLINE IN THE UNITED STATES AND SELECTED EUROPEAN COUNTRIES (Constant excise taxes and exchange rates) a/

	Percentage Change, January 1976 Over October 1973	Percentage Change, June 1979 Over October 1973
United States	45	115
France	26	39
Italy	23	27
United Kingdom	50	110
Germany	20	50

SOURCE: Central Intelligence Agency, National Foreign Assessment Center, International Energy Review (June 24, 1980), p. 20.

a/ These calculations hold excise taxes at their 1973 levels. Since the OPEC oil price is denominated in dollars, the home currency price of gasoline in foreign countries will vary with the dollar exchange rate. To calculate the home currency price change that would have occurred in the absence of exchange rate changes, it is necessary to make an appropriate deduction from the home currency price change when that currency depreciates against the dollar, and to make an appropriate addition to the home currency price change when that currency appreciates against the dollar. (These calculations are presented in detail in Appendix B.)

OIL PRICE INCREASES INDIRECTLY RAISE NONENERGY PRICES BY INCREASING INPUT AND SUBSTITUTE PRICES

Effects on Input Prices

An oil price increase will raise the prices of goods whose production requires significant inputs of energy. 2/ Not only do the prices of oil and direct oil substitutes rise, but so do the prices of products that use energy-intensive inputs. For example, the price of garbage bags will rise because of the rise in the price of input fuels, as will the price of energy-intensive but nonfuel commodities such as steel or aluminum.

Based on the 1967 U.S. input-output table, $366.3 billion of such nonenergy consumption required $18.3 billion in energy inputs (Table 5). If this sample typifies the $466.5 billion of all nonenergy consumption in 1967, then 1/20 of any given percentage oil price increase would show up in the average price paid for nonenergy consumer goods. For example, a 100 percent rise in oil prices would, in this way, increase the average price of nonenergy consumer goods by 5 percent. 3/

Consumers devote about 4.9 percent of their expenditures directly to energy (Table 5), where 100 percent of any oil price increase shows up in the average price. Therefore, the total of direct and "input" effects of an oil price rise on consumer prices is just under 10 percent, nearly twice the size of the more easily measured direct effects.

2/ Increases in oil input prices do not seriously affect the GNP deflator. Because GNP is a measure based on value added in production, the GNP deflator will rise by the same amount when firms use a fixed absolute markup over cost, whether domestically produced oil is an intermediate or a final good. When firms use a fixed percentage markup over costs, then oil used as an intermediate good will have some additional inflationary effect on the GNP deflator. But the Consumer Price Index is not based on value added in production, so irrespective of whether oil is an intermediate or a final product, rises in its price indirectly raise the consumer price level.

3/ This assumes energy cost increases are passed along in an identical absolute markup; a fixed percentage markup over cost would increase the impact on the final product price.

TABLE 5. DIRECT AND ESTIMATED INDIRECT WEIGHTS OF EXPENDITURES ON ENERGY CONSUMPTION IN TOTAL EXPENDITURES ON CONSUMPTION, 1967

Expenditure Category	Billions of Dollars or Percentage
Total Personal Consumption Expenditures	490.7
Direct Expenditures	
Coal	0.1
Crude oil	0.0
Refined petroleum products	10.7
Electricity, gas, water, sanitary services a/	13.9
Total direct expenditures on above products	24.7
As a percentage of total consumption	(4.9)
Inputs of Above Industries to Other Sampled Consumer Expenditures b/	
Total sampled c/	366.3
Coal input	0.7
Crude oil input	3.2
Refined petroleum input	5.6
Electricity, gas input	8.8
Total of inputs	18.3
As a percentage of total sampled	(5.0)
Total Direct Consumption of Energy Industries	24.2
Total Estimated Indirect Consumption of Energy Industries d/	23.3
Total Direct and Indirect Consumption	47.5
Total Energy Consumption as a Percentage of Total Final Consumption	(9.7)
Ratio of Total Energy Weight to Direct Energy Weight	1.98

(continued)

TABLE 5. (continued)

SOURCE: Calculated from data in U.S. Department of Commerce, Interindustry Economics Division, "The Input-Output Structure of the U.S. Economy: 1967," Survey of Current Business (February 1974), pp. 24-56. Personal consumption data were taken from Table 1, p. 43; total direct and indirect requirements for the sampled sectors of personal consumption were taken from Table 3, pp. 52-55.

a/ Water and sanitary services are included with gas and electric in the 85-industry table shown in the Survey of Current Business. In 1970, 59 percent of the personal consumption expenditure of the total output of this group was produced by electric utilities, 30 percent was produced by gas utilities, and 11 percent was produced by water and sanitary services. With the subsequent rise in energy prices, the share of water and sanitary services has probably fallen even further, so treating the entire industry as being in the energy sector produces no important error. U.S. Department of Labor, Bureau of Labor Statistics, "The Structure of the U.S. Economy in 1980 and 1985," Bulletin 1831 (1975).

b/ These figures were derived by multiplying the direct and indirect requirements per dollar of delivery to final demand for the four energy-related industries, taken from Table 3 of the reference cited, by final consumption of each of the sampled industries taken from Table 1.

c/ The individual nonenergy components of personal consumption included in the sample, chosen because they were large, were food and kindred products ($60.9 billion), apparel ($16.2 billion), motor vehicles and equipment ($15.8 billion), transportation and warehousing ($11.4 billion), wholesale and retail trade ($109.4 billion), finance and insurance ($25.3 billion), real estate and rental ($70.9 billion), hotels and personal and repair services ($15.5 billion), and medical, educational services, and non-profit institutions ($41.1 billion).

d/ The product of the 5 percent energy use found in the sample of indirect energy consumption times total consumption of non-energy items ($490.7 - $24.2).

The Substitution Effect

An energy price rise can also increase the prices of non-energy-intensive substitutes for energy. So, for example, bicycle prices might rise because of a sudden increase in demand for substitutes for fuel-intensive forms of transportation; or the price of natural-fiber clothes might rise as demand shifted to them because of energy-related increases in synthetic fiber prices. Some substitute price increases would be offset by declines in the prices of products that are "complements" to fuel-intensive energy uses: the prices of less fuel-efficient used cars, for example, might fall, as might rental rates at distant resorts. Broadly, however, most commodities are probably substitutes, not complements: an oil price rise will increase the average price of nonenergy substitutes.

Prices of nonenergy substitutes would not, typically, rise more than the original oil price increase, for then the relative oil price would have fallen. But they could rise by any amount up to the original oil price increase. The ensuing range of estimates is large: considering only the direct substitute and input effects, a 100 percent oil price rise would increase consumer prices by 5 to 10 percent; but including the wider possible substitution of nonenergy products for energy products, consumer prices could rise more. The direct substitute and input effects provide a minimum estimate of the direct impact of an oil price rise on the general price level.

Feedback Into Wages and Prices

Where labor or industrial units have sufficient bargaining power, they may attempt to raise wages and prices to restore their previous real incomes or profits. Including these wage and price effects would raise the estimated final impact of an oil price rise on the general price level.

MONETARY POLICY CONSTRAINS THE OVERALL PRICE INCREASE

The foregoing arithmetic assumes that the price effects are left free to work themselves out. But in practice the final inflationary effect of an oil price rise is limited by the supply of money. The monetary authorities, in their effort to restrain inflation, limit the increase in the general price level at the cost of an increase in unemployment.

Policy decisions by the central bank are critical in this, because an increase in the total value of transactions can only take place if the bank provides a sufficient volume of credit to sustain it. The precise amount of money that the bank must provide depends upon structural features of the economy (such as billing and collection procedures), the presence of close substitutes for money (such as credit cards), and other features of the economy that change only slowly. To keep oil-related price increases from permanently raising the price level, the central bank would have to hold the credit supply constant. If it did, the oil price increases would not lead to an increase in the total value of transactions. Instead, consumption and investment would fall, choked off by interest rate increases and credit restrictions. Eventually, rising unemployment and excess capacity would reduce non-oil prices. The price level, capacity utilization, and unemployment would ultimately return toward the levels that existed before the price rise.

Any central bank would face great political obstacles to pursuing such a policy: the short-term rise in unemployment and excess capacity would be too great. Central banks will typically increase the amount of credit by enough to accommodate part of the oil price rise.

The part of the oil price rise that the central bank chooses to accommodate appears as a rise in the general price level; the part it does not choose to accommodate produces a rise in unemployment and excess capacity. The central bank's choice is unpleasant and difficult (as will be discussed further in Chapters III, VI, and VII), because no known combination of monetary and other policies can avoid both unemployment and inflation after an oil price rise. Nonetheless, it is essential to recognize that the central bank does choose a response to OPEC pricing policies, because changes in that response, and in the domestic environment in which central bank policy is made, can reduce the costs of unemployment and inflation that follow an oil price increase. These costs could be reduced even while leaving unchanged the loss of purchasing power that occurs with the higher oil price.

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CHAPTER III. HOW OPEC OIL PRICE INCREASES REDUCE REAL DISPOSABLE INCOME, REAL GNP, AND EMPLOYMENT

When OPEC raises the oil price, policymakers in oil-importing countries have no domestic policy tool that can prevent the increased payments to OPEC and the corresponding decline in real disposable income. Living standards, relative to what they would have been, must decline. Policymakers could use tax and transfer policy to raise the after-tax disposable income of the present generation of citizens. But such a program would only pass on its costs to future generations (see below and Chapter VII). The living standard attainable at full employment in oil-importing countries falls by an amount equal to the difference in the cost of oil when priced by the OPEC cartel and the cost when priced in a competitive market. For the OECD countries, that difference amounted to between $65 billion and $150 billion in 1979 (Chapter VII).

Policymakers in oil-importing countries do have tools that would prevent the declines in economic activity that generally follow OPEC price rises; they typically choose not to use these tools fully, however, because they fear inflation. Thus, OPEC price rises not only cause the permanent loss of purchasing power discussed above; they also produce short-term unemployment. The recession of 1974-1975, in part attributable to the oil price hike, cost the OECD countries about $350 billion, as measured by the deviation of real GNP from its trend value (Chapter VII).

This chapter begins with a discussion of the channels through which OPEC price increases reduce real disposable income in oil-importing countries, and goes on to show how those price increases, combined with policymakers' reluctance to offset their effects, produce unemployment and declines in real GNP.

POLICYMAKERS CANNOT OFFSET THE DECLINE IN POTENTIAL REAL DISPOSABLE INCOME IN OIL-IMPORTING COUNTRIES

Even when policymakers take steps to ensure that unemployment does not rise, real disposable income in oil-importing countries must fall. For most oil-importing countries, oil

consumption is larger relative to total consumption than is oil production relative to total domestic production, so that increases in the price of oil typically raise the cost of those goods that citizens prefer to consume relative to the value of the goods and services that they produce. 1/ With no change in taxes or in government transfers, consequently, a rise in the oil price will reduce real disposable income (see Appendix C).

Certain government policies could shield citizens from an immediate reduction in real disposable income, but only at the expense of future generations. The government could reduce taxes, for example, to push real income back up to its level prior to the oil price rise. By doing this, the government could ensure that consumers were able to maintain their real purchasing power and savings levels. But more of the oil-importing country's unchanged GNP (its own real production) must be exchanged for OPEC oil. If other consumption doesn't change, then a larger fraction of GNP must be devoted to consumption and less, therefore, to domestic and foreign investment. If consumption is maintained at the expense of domestic investment, then a smaller capital stock and a lower potential GNP will be passed on to future generations of citizens. If both real consumption and real investment are maintained at their preceding levels, then the extra resources must be obtained from overseas: the current account will decline and fewer foreign assets (or a larger foreign debt) will be passed on to future generations. (Sometimes this ability to redistribute the burden among generations produces better macroeconomic policy choices, a point discussed in Chapter VII.)

No domestic policy can raise the real disposable income of all generations to what it was before an oil price increase. Policymakers can restore the previous potential real disposable income only if OPEC is induced to lower its oil price (Chapter VII).

1/ For all oil-importing countries, domestic consumption of oil must exceed domestic production. But for those same countries, domestic consumption of all goods will typically be less than domestic production of all goods (GDP). Therefore, oil consumption will be larger relative to total consumption than will be oil production relative to total production.

POLICYMAKERS DO NOT FULLY OFFSET THE DECLINE IN ECONOMIC ACTIVITY IN OIL-IMPORTING COUNTRIES

When an oil price rise reduces real disposable income in oil-importing countries, it also reduces consumer demand. Consumers, who must pay for more expensive oil products, now find they cannot purchase the same quantities of other goods as before.

This drop in consumer demand could be offset by fiscal and monetary measures. Policymakers typically choose not to offset it fully, however, because they are concerned with the inflationary consequences of oil price increases on general domestic price levels. Policymakers typically choose to combat this inflation to some extent, so they cannot at the same time offset all of the depressing effects of oil price increases on GNP and employment.

Oil Price Increases Reduce GNP in Oil-Importing Countries by Depressing Demand

Oil price increases reduce GNP in oil-importing countries when offsetting policies are absent because oil imports do not fall sufficiently in response. If, for example, a price rise triggered an expansion of domestic oil production, GNP (that is, nationally produced real output) would rise. Similarly, if an oil price rise shifted demand to non-oil products, and domestic economic slack was available to produce those products, GNP might also rise. But in the short run, consumers cannot avoid spending more for imported oil and, therefore, less on domestically produced goods. Thus, an oil price rise functions like a tax, depressing GNP. 2/

This drop in real GNP and domestic employment will be greater when:

- oil-exporting countries run large trade surpluses, thereby failing to substitute their own demand for the slack left by the fall in domestic demand in oil-importing countries;
- domestic oil and energy production does not rise in response to price increases;

2/ They differ in that, where legal compulsion leads consumers to pay increased personal taxes, inelastic or intense demand leads consumers to pay an increased total oil bill.

- domestic energy production is small relative to consumption, so that the rise in price redistributes income primarily to foreigners rather than to domestic residents; or

- oil consumption is a large fraction of total consumption and is relatively insensitive to price changes.

Aside from these aggregate demand and oil supply effects, a rise in the price of oil, by itself, would not raise the real GNP of an oil-exporting country; nor would it lower the GNP of an oil-importing country. Attention to real GNP is essential, for if real GNP does not change, neither will employment. As discussed above, an oil price rise must reduce real disposable income; but it need not reduce real GNP and raise unemployment (discussed further in Appendix C).

Real gross national product measures the quantity of goods produced by the productive factors owned by the nationals of a country. If an oil price increase does not raise oil production in an oil-exporting country, and if the economy is otherwise fully employed so that the increase in real disposable income does not raise domestic production of other goods or services, then real GNP cannot rise. Without an increase in real GNP, domestic employment cannot rise. 3/ Similarly, an oil price rise would reduce real disposable income in an oil-importing country, but policymakers could offset that drop in disposable income, thereby preventing real GNP from falling; were they to do that, unemployment would not rise. Real GNP measures the volume of output, not its price; and employment depends upon the volume of output.

Fearing Inflation, Policymakers Do Not Fully Offset OPEC-Caused Demand Reductions

Oil-importing countries could use monetary and fiscal policies to offset the depressing effect of an oil price rise.

3/ For example, Saudi Arabian oil exports rose in value by a factor of five between 1973 and 1977, while nominal GNP rose by a factor of six. But real GNP rose over the same period by only 45 percent; and about one-half of that rise, or 20 percentage points, reflected a rise in oil production. International Monetary Fund, International Financial Statistics (December 1980), p. 332.

Indeed, such tools could eliminate the drop in real GNP and employment. But because an oil price rise has its depressing effect in combination with an inflationary effect (see Chapter II), policymakers will not combat the unemployment alone. The declines in GNP and employment follow from the inability of policymakers in oil-importing countries to achieve both inflation and unemployment rate targets after an oil price rise, not directly from the price rise itself.

Oil Price Increases May Reduce Full-Employment GNP

An oil price rise may also reduce GNP from the supply side by making it less profitable to maintain former production levels with the existing capital stock and labor force. This may occur when a rise in the oil price makes the existing set of factors of production less productive.

For any single (non-oil-owning) business firm, a rise in the price of oil will reduce that firm's profit and its demand for labor and capital. But the economy-wide effects of an oil price rise could accentuate or offset this. A rise in the oil price changes the demand for capital and labor. An oil price rise, for example, may reduce both the demand for and the cost of labor, so that a firm's total costs actually are unchanged relative to its total revenues. Or, the demand for capital may fall at the same time that a rise in demand for labor increases a firm's costs by even more than the increase in its fuel bill.

What happens, on average, over an entire economy that possesses industries with quite different characteristics is a difficult empirical question. There is some evidence that a rise in the OPEC oil price leads, at least in the short run, to simultaneous economizing on both energy and capital. Capital and energy, by that account, are complements in the short run, while labor is a substitute for both. 4/

4/ Robert H. Rasche and John A. Tatom, "The Effects of the New Energy Regime on Economic Capacity, Production, and Prices," Federal Reserve Bank of St. Louis Review (October 1979); Savas Ozatalay, Stephen Grubaugh, and Thomas Veach Long II, "Energy Substitution and National Energy Policy," American Economic Review (May 1979); E.R. Berndt and D.O. Wood, "Technology, Prices, and the Derived Demand for Energy,"

If this is correct, a rise in the price of oil simultaneously reduces the value of the existing capital stock, the output that it can profitably produce, and (temporarily) the incentive to add to that capital stock by investing.

Policymakers may not be able to remedy such a fall in potential GNP and investment incentives with monetary and fiscal tools. Obviously, the government can use monetary and fiscal policies to lower investment costs and raise the after-tax return on investment to offset the effects of an oil price increase. But this may not be socially efficient. Private companies desire a lower capital stock at the higher energy price because they can produce output more efficiently with the new combination of capital, energy, and labor. Subsidizing capital, in such an environment, would increase its rate of formation. But by adding to the capital stock projects that do not cover interest costs, such policies lower productive efficiency.

This problem is potentially very serious. But the empirical evidence for the size and the direction of the effect is still tentative, and the analysis presented in this paper will not make further use of this finding.

Review of Economics and Statistics (August 1975); J.M. Griffin and P.R. Gregory, "An Intercountry Translog Model of Energy Substitution Responses," American Economic Review (December 1976); E.A. Hudson and D.W. Jorgenson, "U.S. Energy Policy and Economic Growth, 1975-2000," Bell Journal of Economics (Autumn 1974).

CHAPTER IV. HOW OPEC OIL PRICE INCREASES AFFECT TRADE BALANCES WITH OIL-IMPORTING COUNTRIES

OPEC oil price increases markedly change trade balances with oil-importing countries. Immediately after OPEC raises the oil price, its members typically run a trade surplus: they cannot increase their expenditures quickly enough. If OPEC collectively runs a surplus, then non-OPEC countries must, collectively, run a deficit.

Aside from the trade policies adopted by oil-importing countries (discussed in Chapter VII), several factors determine the distribution of the non-OPEC deficit. An oil-importing country's trade deficit will rise more with an OPEC price rise, the greater the volume of its oil imports relative to total imports. U.S. oil imports have risen relative to total imports since 1973, so the U.S. trade balance is now more sensitive to oil price increases (see Appendix D).

An oil-importing country's trade deficit will rise more when GNP rises, the smaller the volume of oil imports relative to total oil consumption. Since the United States is more self-sufficient in oil production than most industrial countries, any increase in total oil demand will cause a larger percentage increase in oil imports in the United States than it will in another, less self-sufficient country. Compared with those of other industrial countries, the U.S. trade balance with OPEC fluctuates more during recession and recovery. For this reason, as its GNP grew between 1973 and 1978, U.S. oil imports rose at a faster percentage rate than did oil imports of other industrial countries. This relatively sharp rise in U.S. imports followed from greater initial U.S. self-sufficiency, not from a smaller U.S. response to rising oil prices.

UNABLE TO ADJUST SPENDING TO REVENUES QUICKLY, OPEC RUNS A CURRENT ACCOUNT SURPLUS

For OPEC members as a group, total expenditures on imported goods and services lag behind their oil export revenues. The lag in expenditures produces surpluses on OPEC's goods and services account.

The OPEC surplus is produced by a few major oil producers who fail to spend all their revenues. There are many reasons for this: their governments may believe that bottlenecks or expected social instability will reduce the returns expected from additional investment; private citizens may desire to save current oil-related payments because they expect superior investment opportunities in the future, because they desire to hold overseas assets as precautions against domestic instability, or because they are sated; their governments may believe that additional military equipment will not buy additional security; or their major suppliers may not sell them the weapons they want.

Why Does the OPEC Surplus Matter?

If OPEC members run a collective surplus, the rest of the world must run a collective deficit. This feature of the oil price rise must create disharmony, since policymakers in oil-importing countries cannot collectively succeed in eliminating their deficits if OPEC has a surplus. The struggle to eliminate deficits must frustrate at least some policymakers.

The fact that OPEC runs a collective surplus, however, does permit more oil-importing nations to defer the burden of reducing domestic consumption and investment because of the higher OPEC oil price. The surplus allows oil-importing countries to maintain domestic consumption and investment by borrowing from OPEC. When the OPEC surplus is gone, oil-importing countries will have to deliver goods and services to pay for oil; perforce, they will no longer be able to consume and invest those goods and services themselves.

Finally, the OPEC surplus has an important bearing on what happens to the dollar exchange rate as a result of an oil price increase. For reasons discussed in Chapter V, much of the OPEC surplus is invested in dollar-denominated assets. In the exchange rate response, OPEC's demand for dollar assets helps outweigh the increases in trade deficits discussed in this chapter. This asset demand for dollars contributes to the result, discussed in Chapter VI, that oil price increases initially cause the dollar to rise.

What is the Regional Distribution of the OPEC Surplus?

While non-OPEC countries must collectively have a deficit, that deficit can be distributed in many ways among them. More-

over, the distribution itself can change over time. In 1973, for example, the U.S. deficit with OPEC countries was $2.1 billion, considerably smaller than the "other industrial countries'" $12.1 billion combined deficit with OPEC and less than half the "rest of the world's" $5.1 billion combined deficit (Table 6). By 1978, that had changed. The U.S. deficit with OPEC had reached $12.9 billion, about the same as the $13.2 billion deficit that other industrial countries had with OPEC and more than half the rest of the world's deficit with OPEC (Table 6).

The swing in U.S. deficits with OPEC occurred mainly because of the greater sensitivity of U.S. oil imports to income changes. In order to see the importance of income changes, the first of the following two sections discusses the likely evolution of trade balances assuming that oil-importing countries undertake policies to hold GNP and current disposable income constant; the second section discusses the evolution of trade balances when oil-importing countries' incomes vary.

THE U.S. TRADE BALANCE HAS BECOME MORE SENSITIVE TO OPEC PRICE INCREASES

To isolate the effects of price changes, this section assumes that oil-importing countries use macroeconomic policies to maintain GNP and employment, and tax and transfer policy to maintain disposable income. (There is, of course, no way to maintain the real disposable income of this generation of U.S. citizens without reducing that of future generations of U.S. citizens. 1/)

If income does not change, and if the short-term response of oil demand and supply to a price change is zero, then the volume of oil imports will not change. Under these assumptions, the

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1/ To raise real disposable income to the level citizens enjoyed before the OPEC price rise, the government could reduce taxes or increase transfer payments. The consequent rise in the budget deficit would require an offset. If the offset took the form of a fall in investment, then the present generation would maintain its consumption by passing on a smaller capital stock to future generations. If the offset took the form of a drop in the current account, the present generation would maintain its consumption by passing on smaller foreign assets (or larger foreign debts) to the next generation.

TABLE 6. OPEC TRADE WITH THE UNITED STATES AND SELECTED REGIONS, 1973-1978

	Trade (billions of dollars)			Percentage Change		
	1973	1975	1978	1975 over 1973	1978 over 1975	1978 over 1973
United States						
Exports to OPEC	3.4	10.4	16.0	206	54	371
Imports from OPEC a/	5.5	18.4	28.9	235	57	425
Trade Balance	-2.1	-8.0	-12.9	--	--	--
Other Industrial Countries b/						
Exports to OPEC	11.8	33.6	58.4	185	74	395
Imports from OPEC	23.9	60.3	71.6	152	19	200
Trade Balance	-12.1	-26.7	-13.2	--	--	--
Rest of the World c/						
Exports to OPEC	4.2	10.7	17.9	155	67	326
Imports from OPEC	9.3	29.9	39.2	222	31	322
Trade Balance	-5.1	-19.2	-21.3	—	—	—

SOURCE: Regional trade flows taken from International Monetary Fund, Direction of Trade Yearbook, 1979. To avoid problems of inconsistency between export and import data, only export data were used to construct the trade tables.

a/ Replaces IMF data on U.S. imports from OPEC (of $4.6 billion, $13.3 billion, and $28.9 billion for 1973 to 1978) with larger figures representing about 77 percent of total U.S. imports of petroleum and petroleum products. U.S. net imports of petroleum and petroleum products amounted to $7.1 billion, $23.9 billion, and $37.5 billion in 1973, 1975, and 1978, respectively. (See U.S. Department of Commerce, Survey of Current Business (March 1979), p. S-23; U.S. Department of Commerce, Business Statistics, 1977, pp. 111, 115.) A great deal of imported refined petroleum comes indirectly from OPEC through offshore refining centers and is not reported as an import from OPEC. But when OPEC raises the oil price, the United States would pay, and OPEC would receive, the bulk of increased revenue; the intermediate refiner would retain little of the increase. This table makes a rough correction for this problem by attributing to OPEC member countries all oil imports from those countries in Central America and the Caribbean where oil production is zero. Such imports amounted to about 10 percent of total U.S. imports in 1979 and raised total imports from OPEC to 77 percent of total U.S. imports of petroleum and petroleum products. (See U.S. Department of Energy, "Supply, Disposition, and Stocks of All Oils by P.A.D. Districts and Imports in the United States, by Country" (December 1979), p. 8; U.S. Department of Energy, International Petroleum Annual, 1978, p. 16.)

b/ Includes Austria, Belgium, Canada, Denmark, France, Germany, Italy, Japan, Netherlands, Norway, Sweden, Switzerland, and the United Kingdom.

c/ Excludes the United States, other industrial countries, and OPEC member countries; includes the developing countries, some smaller European countries, Australia, New Zealand, and South Africa.

total value of oil imports will rise in step with oil price increases.

The change in exports to OPEC will depend on how much of its increased disposable income OPEC will spend. Between 1973 and 1978, OPEC spent about 72 percent of its increased oil revenues on imports. If the oil-importing nations' shares of exports to OPEC remain unchanged, as they did between 1973 and 1978, then the value of their exports to OPEC will also rise in step with oil price increases.

The effects of a hypothetical 100 percent oil price increase under 1973 conditions are shown in Table 7. The deficits of all oil-importing countries would have increased, but the increase in the U.S. trade deficit would have been smaller than those of other country groups. This would be because the United States imported relatively little oil.

By 1978, because of the rise in U.S. oil imports, this would no longer have been the case. By that time, a hypothetical 100 percent oil price increase would have raised the U.S. deficit by $11.4 billion, while increasing the deficit of other industrial countries by only $7.8 billion. The U.S. trade balance became more sensitive to oil price increases, as will be discussed below, because U.S. income growth raised U.S. oil imports more.

THE U.S. TRADE BALANCE WITH OPEC CHANGES MORE WITH INCOME THAN DO THE TRADE BALANCES OF OTHER COUNTRIES

The U.S. trade deficit with OPEC rose, relative to those of other industrial countries, because of the relatively sharp rise in U.S. oil imports. U.S. exports to OPEC, by contrast, increased by about the same amount as other industrial countries' exports to OPEC.

U.S. oil imports have been more sensitive to income changes primarily because of the initially greater U.S. self-sufficiency in oil. Of secondary importance was the drop in U.S. oil production that occurred while production in other OECD countries was rising. Differences in "conservation" behavior explain only a minor part of differences in increases in oil imports.

The greater sensitivity of U.S. imports to income growth is important for two reasons:

TABLE 7. EFFECTS OF A HYPOTHETICAL 100 PERCENT OPEC PRICE INCREASE ON TRADE BALANCES WITH OPEC (Billions of dollars)

	Forecast Based on 1973 Trade Balances			Forecast Based on 1978 Trade Balances		
	Base	Predicted	Change a/	Base	Predicted	Change a/
United States						
Exports to OPEC	3.4	8.3	--	16.0	33.5	--
Imports from OPEC	5.5	11.0	--	28.9	57.8	--
Trade Balance	-2.1	-2.7	-0.6	-12.9	-24.3	-11.4
Other Industrial Countries						
Exports to OPEC	11.8	28.8	--	58.4	122.2	--
Imports from OPEC	23.9	47.8	--	71.6	143.2	--
Trade Balance	-12.1	-19.0	-6.9	-13.2	-21.0	-7.8
Rest of the World						
Exports to OPEC	4.2	10.2	--	17.9	37.5	--
Imports from OPEC	9.3	18.6	--	39.2	78.4	--
Trade Balance	-5.1	-8.4	-3.3	-21.3	-40.9	-20.4
Memo						
OPEC Exports	38.7	77.4	--	139.7	279.4	--
OPEC Imports	19.4	47.3	--	92.3	193.2	--
OPEC Trade Balance	19.3	30.1	10.8	47.4	86.2	38.8

SOURCE: Actual data are from Table 6. If oil-importing countries keep disposable income and GNP unchanged, and if the short-term elasticity of demand for OPEC (oil) exports (X) with respect to the oil price (P) is zero, then the projected export increase, dX/X, equals dP/P. The projected rise in OPEC oil exports would equal, by definition, the projected rise in non-OPEC oil imports. To predict the change in OPEC imports, assume that the change in OPEC imports (dM) is fixed relative to the change in exports (dX), so that $dM = m\,dX$. Divide through by X to obtain $dM/X = m(dX/X) = m(dP/P)$, and rearrange to get $dM/M = m(X/M)(dP/P)$. The value of "m" is calculated from the memo item in this table; over the period 1973 to 1978, "m" was approximately equal to $[(92.3 - 19.4)/(139.7 - 38.7)]$, or about 0.72. The value of M/X is also shown in the memorandum to this table. Assuming constant shares in the OPEC market, the predicted percentage increase in each oil-importing country's exports to OPEC equals the percentage increase in total OPEC imports.

a/ Negative numbers indicate an increase in deficit or a decrease in surplus; positive numbers, a decrease in deficit or an increase in surplus.

- When an oil price increase leads to a recession, the U.S. trade balance with OPEC will improve much more than will the trade balances of other industrial countries;

- But during the recovery, and during periods of normal economic growth, the U.S. trade balance with OPEC will worsen much more than will those of other industrial countries.

Industrial Country Exports to OPEC Have Changed Similarly

U.S. export performance does not explain the rise in the U.S. deficit with OPEC relative to the rise in the deficits of other industrial countries. U.S. exports to OPEC rose by 371 percent between 1973 and 1978, while exports of other industrial countries to OPEC rose by 395 percent (Table 6). Had U.S. exports risen by the same amount as those of other industrial countries, the U.S. deficit would not have been much different: $15.1 billion instead of $16 billion. In sharp contrast to the $10.8 billion increase in the U.S. deficit against OPEC, the deficits vis-a-vis OPEC of other industrial countries rose by only $1.1 billion: differences in export performance obviously explain little of the different evolution of deficits.

U.S. Imports from OPEC Are More Sensitive to Income Change Than Are Imports of Other Countries

Because the United States is more self-sufficient in oil production than Japan and most European countries, U.S. income growth will produce larger percentage increases in oil import volumes. U.S. import growth will be greater even when total oil demand responds to price and income changes identically in the United States and in foreign countries.

Suppose, for example, that of two identical countries, one produces half the oil it consumes while the other produces none. Suppose further that each country consumes a total of 10 million barrels per day and that income rises enough to increase oil consumption by 10 percent, to 11 million barrels per day. Imports would then increase by 10 percent in the country that imports all its oil, but they would increase by 20 percent in the relatively "self-sufficient" country.

U.S. oil import volume rose 34.2 percent between 1973 and 1977; the rise in domestic U.S. demand for petroleum accounted for

15.7 percentage points of this increase, while the fall in domestic energy production accounted for 18.6 percentage points (Table 8). But had the United States in 1973 imported the same proportion of its energy as did OECD-Europe, the percentage increase in U.S. imports would have been much smaller: using OECD-Europe weights, U.S. oil imports would have increased by only 6.1 percent from an initially larger base. 2/ Of the 45.8 percentage-point difference between the import changes of the United States (34.2 percent) and of OECD-Europe (-11.6 percent), about 28.1 percentage points, or more than half the difference, followed from the initially higher degree of U.S. energy self-sufficiency.

U.S. Oil Production Fell Relative to OECD-Europe. Of the remaining 17.7 percentage-point difference, about 16.3 percentage points existed because OECD-Europe increased its oil supplies by developing the North Sea oil field; in contrast, U.S. gas and oil production declined. OECD-Europe imports fell by 14.2 percentage points because of increases in domestic energy production. About three-quarters of this import decline resulted from increased gas and oil production. U.S. imports, on the other hand, rose by 2.1 percentage points because of reduced production. Declines in domestic oil and gas production would have increased U.S. imports by 2.3 percent, but were offset by increases in other energy production.

Differences in Adjustment of Demand to Higher Oil Prices Were Not Large. Contrary to popular opinion, differences in adjustment of demand to price and income accounted for only 1.4 percentage points of the total 45.8 percentage-point difference in oil import growth. Demand factors in OECD-Europe explained a 2.6 percentage-point increase in imports, while demand factors in the United States accounted for a 4.0 percentage-point increase in imports (with the United States adjusted to the OECD-Europe base). GNP/GDP growth was the same in the United States and in OECD-Europe during this period, so differences in the evolution of oil demand probably followed from non-income factors, including response to price changes and "conservation" behavior. These non-income demand factors are least important in explaining the different development of U.S. and OECD-Europe oil imports. Contrary to popular accounts that focus on price differences, even

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2/ See Appendix E for a discussion of how weights are used to decompose imports into consumption and production components.

the total absence of such differences would not have prevented the emergence of substantially larger oil imports in the United States. 3/

The memorandum columns of Table 8 show the estimated change in national energy demand produced by non-income factors. A rise in U.S. GNP/GDP of 8 percent between 1973 and 1977 would, by itself, have increased energy demand by an estimated 8 percent. U.S. energy demand actually rose by only 3.2 percent, so non-income factors offset part of the income effect, reducing demand by 4.8 percent. By the same reckoning, non-income factors may have reduced energy demand by 6.4 percent in OECD-Europe and by 6.8 to 8.4 percent in Japan and selected European countries. Yet, for all the attention that has been focused on relative levels of petroleum consumption, the differences in adjustment to higher prices since 1973 are strikingly small.

3/ It is possible, of course, that higher initial U.S. energy consumption meant that the United States could have reduced energy consumption faster than did other countries. If this were the case, data showing similar responses by the United States and other countries to oil price increases might still be consistent with a much lower U.S. response, relative to the potential U.S. response, than occurred in other countries. This paper does not treat this question. It is useful to note, though, that it is not obvious that the United States should have adjusted faster. Automobiles are most commonly cited to support the view that Americans could have adjusted energy consumption more than did Europeans or Japanese. Although the average foreign car gets more miles per gallon than the average American car, it does not follow that U.S. citizens should adjust the composition of their car stock faster. When the gasoline price rises, the prices of the majority of U.S. cars--already manufactured and on the road--simply fall to compensate. The scrapping rate does not rise, older-model cars continue to be used and traded (albeit at lower prices), and, consequently, gasoline consumption does not change significantly.

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TABLE 8. COMPONENTS OF CHANGE IN QUANTITIES OF ENERGY IMPORTS FOR THE UNITED STATES AND SELECTED OECD COUNTRIES, 1973-1977

Country or Country Group	Percentage Change in Import Volume a/	Contribution to Import Change of Percentage Change in Demand		
		Total	Income Component b/	Other Demand Change
1973 to 1977				
United States	34.2	15.7	51.5	-35.9
Japan	3.1	4.7	15.1	-10.3
Germany	-1.0	-3.3	12.4	-15.7
United Kingdom	-50.1	-11.0	2.3	-13.3
OECD-Europe	-11.6	2.6	13.0	-10.4
United States with OECD-Europe weights	6.1	4.0	13.0	-9.1
1973 to 1975				
United States	-9.8	-32.7	-14.4	-18.3
Japan	-3.1	-1.5	1.1	-2.6
Germany	-15.3	-16.1	-2.9	-13.2
United Kingdom	-22.6	-18.5	-7.0	-11.6
OECD-Europe	-13.9	-8.6	1.6	-10.2
United States with OECD-Europe weights	-9.8	-8.3	-3.7	-4.6
1975 to 1977				
United States	48.7	53.6	71.0	-17.3
Japan	6.4	6.4	14.1	-7.6
Germany	16.9	15.1	16.7	-1.6
United Kingdom	-35.5	9.7	11.3	-1.6
OECD-Europe	2.6	12.9	12.3	0.6
United States with OECD-Europe weights	13.5	14.2	18.8	-4.6

(continued)

SOURCES: Imports are derived from energy demand and production data taken from OECD, Energy Balances of OECD Countries, 1960/1974 (Paris, 1976) and Energy Balances of OECD Countries, 1975/1977 (Paris, 1979). Income data are GDP data taken from OECD, Main Economic Indicators (October 1979). See Appendix D for derivation. Detail may not add to totals because of rounding.

a/ Total energy imports, converted to million tons of oil equivalent, and expressed as percentage change over the base period.

TABLE 8. (Continued)

Contribution to Import Change of Percentage Change in Production			Memorandum		
Total	Oil and Gas	Other	Gross Domestic Product (percentage change)	Total Energy Demand (percentage change)	Percentage Demand Change Not Attributed to Income Change
18.6	45.5	-26.9	8.0	3.3	-4.8
-1.6	0.1	-1.7	12.1	3.7	-8.4
2.3	1.1	1.2	6.8	-1.5	-8.3
-39.1	-42.7	3.7	1.2	-5.6	-6.8
-14.2	-10.6	-3.6	8.0	1.6	-6.4
2.1	2.3	-0.1	--	--	--
23.0	39.5	-16.5	-2.3	-4.4	-2.1
-1.6	0.1	-1.7	1.0	-1.8	-2.8
0.8	1.0	-0.3	-1.6	-8.5	-6.9
-4.0	-6.5	2.5	-3.5	-9.3	-5.8
-5.3	-3.7	-1.6	1.0	-5.3	-6.3
2.6	2.0	0.7	--	--	--
-4.9	6.6	-11.5	10.5	7.9	-2.6
0.0	0.0	0.0	11.0	5.6	-5.4
1.9	0.1	1.8	8.5	7.7	-0.8
-45.3	-46.8	1.5	4.8	4.1	-0.7
-10.3	-7.9	-2.4	6.9	7.2	0.3
-0.7	0.5	-1.1	--	--	--

b/ Appendix D discusses the separation of the total demand change into its income and non-income components. The income component assumes an income elasticity of demand of 1. This is about the historical value of the income elasticity assumed in the OECD energy projections. (See OECD, Energy Policies and Programmes of IEA Countries, 1978 Review (Paris, 1979), pp. 74, 97, 139, 147.) Any adjustment of demand beyond this is attributable, broadly, to other factors, including adjustment to past and current price changes, excise taxes, and special government programs.